

Muon g-2 April Disassembly Trip

Chris Polly

FY12 MOU with Brookhaven

**MEMORANDUM OF UNDERSTANDING
BETWEEN BROOKHAVEN NATIONAL
LABORATORY AND FERMI RESEARCH
ALLIANCE, LLC**

DATED MARCH 20, 2012

**STATEMENT OF WORK
FOR**

**FY12 DISASSEMBLY OF COMPONENTS OF
THE MUON g-2 STORAGE RING AND
BEAMLINE AND THE DELIVERY OF
SPECIFIC COMPONENTS TO FERMILAB**

March 20, 2012

I. Preamble

This Statement of Work (SOW) is made between Brookhaven National Laboratory (BNL) and the Muon g-2 Project in the Fermi National Accelerator Laboratory Particle Physics Division (Fermilab). This document represents an understanding between BNL and Fermilab in connection with the disassembly of components of the E821 Muon g-2 storage ring, beamline, and the delivery of specific components to Fermilab in FY12. We plan to move the E821 muon storage ring coils and steel from BNL to Fermilab in FY13.

As part of this MOU, Brookhaven is providing \$200k of effort in FY12 towards the decommissioning of the E821 beamline. Fermilab is also providing \$200k (\$151k to BNL) of effort in FY12 towards the disassembly of components of the storage ring, and the transportation of equipment from Brookhaven to Fermilab. This is a continuation of work started in FY11 under a separate agreement.

Relatively modest effort in FY12:

- \$200k from FNAL for disassembly of the E821 storage ring

-\$200k match from BNL to decommission beamline and prepare for shipping

List of magnet and instrumentation coming from BNL

Quadrupoles		Trim Dipoles	
Location	Magnet	Location	Magnet
VQ9	4Q26.5 - 6	V1P399	4D16 - 5
VQ10	5Q36 - 02	V1P411	4D16 - 2
VQ11	5Q36 - 07	V1D424	4D16 - 1
VQ12	N3Q36 - 21	V1D452	4D16 - 4
V1Q3	4Q16 - 21	V1P464	4D16 - 3
V1Q4	4Q16 - 23	V1P546	4D16 - 6
V1Q5	4Q16 - 22	V1D566	4D16 - 7
V1Q6	4Q16 - 24	V1P587	4D16 - 8
V1Q7	8Q24 M116	V1P648	4D16 - 9
V1Q8	8Q24 M121	V1P680	4D16 - 10
V1Q9	4Q24 - 4	V1P694	4D16 - 11
V1Q10	4Q24 - 22	V1D710	4D16 - 12
V1Q11	4Q24 - 5	Instrumentation	
V1Q12	4Q24 - 6		
V1Q13	4Q24 - 7	Location	Type
V1Q14	4Q24 - 8	V1W409	SWIC
V1Q15	4Q24 - 9	V1W430	SWIC
V1Q16	4Q24 - 10	V1W450	SWIC
V1Q17	4Q24 - 11	V1W470	SWIC
V1Q18	4Q24 - 12	V1W608	SWIC
V1Q19	4Q24 - 13	V1W646	SWIC
V1Q20	4Q24 - 14	V1W678	SWIC
V1Q21	4Q24 - 15	V1W712	SWIC
V1Q22	4Q24 - 16		
V1Q23	4Q24 - 17		
V1Q24	4Q24 - 18		
V1Q25	4Q24 - 19		
V1Q26	4Q24 - 20		
V1Q27	4Q24 - 21		
V1Q28	8Q24 M113		
V1Q29	8Q24 M122		



3-4 of the requested magnets either still used or too hot, BNL has offered cold spares from inventory if we really need them

Picture taken two weeks ago...



All magnets disconnected, magnets and stands ready to be palletized and staged for shipping

Two-week work party to work on ring disassembly

Main Cast

- Chris Polly (FNAL)...g-2 project manager
- Hogan Nguyen (FNAL)...g-2 Level II in charge of ring
- Abid Patwa (BNL)...scientist in BNL omega group
- Aria Soha (FNAL)...I&I for g-2
- Kelly Hardin (FNAL)...lead g-2 technician
- Bill Morse (BNL)...resident spokesperson of BNL g-2
- John Benante (BNL)...supervisor who led initial ring construction
- Don Von Lintig (BNL)...lead tech in BNL ring assembly
- Alexander Mikhailichenko (Cornell)...Cornell physicist in charge of EM kickers
- Robin Bjorkquist (Cornell)...Lawrence Gibbon grad student
- Carsten Quinlin (Cornell)...Lawrence Gibbon grad student

Supporting Roles

- BNL pulsed power group
- BNL cyro instrumentation folks
- BNL Health Physics
- riggers
- electricians
- cable crew
- BNL safety, finance, and admin

Really only Kelly spent
two full weeks, rest of us
spent 3-7 days

Technical Task List (BNL/FNAL technician required for work, supervision by BNL employee required):

1. BNL ME to recertify lifting fixtures.
2. Identify and check instrumentation associated with storage ring, cryo, and vacuum.
3. Remove and label instrumentation cables.
4. Undo the two interconnects that connect the upper and lower inner coils (defer for more engineering).
5. Crane detectors out for storage in compressor room.
6. Remove special devices (harps and collimators).
7. Remove chambers (some will require tasks below).
8. Remove quad boxes and power supplies.
9. Remove kickers.
10. Remove trolley box.
11. Remove quad and kicker cabinets from experimental floor.
12. Extract vacuum pumps and controls.
13. Disassemble as much cryolines, valve boxes, and pots as much as possible.
14. Disconnect inflector.

Two task lists
defined in MOU...
technical and general

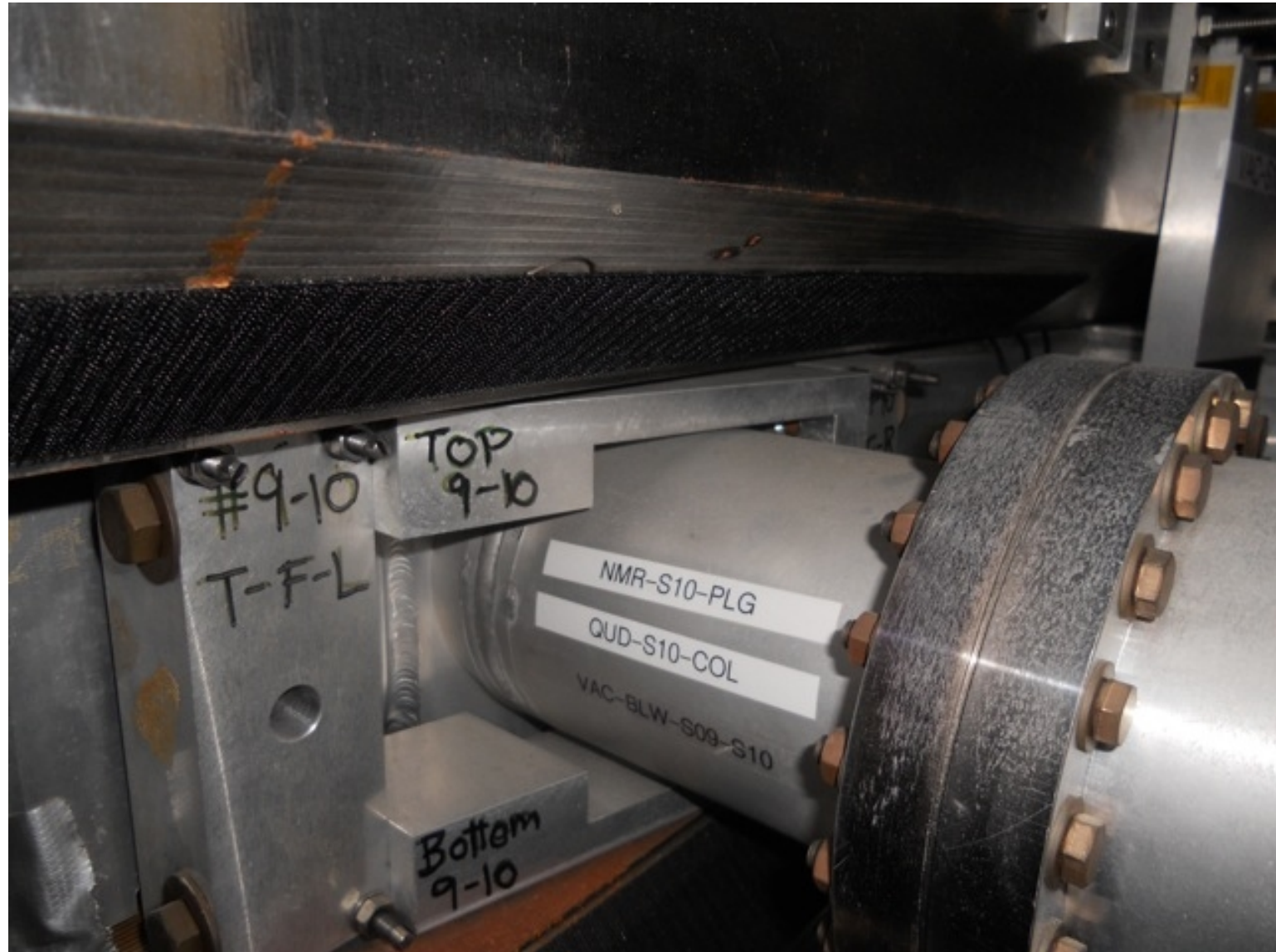
General Task List (E989 collaborators can assist, supervision is extended from BNL employees to also included Chris Polly or Hogan Nguyen):

1. Assist technicians where possible.
2. Pack up equipment in control rooms.
3. Remove and package detector PMTs.
4. Extract RG8 signal cables from calorimeters.
5. Extract laser fiber calibration system.
6. Remove steel floor plates (plates detectors traveled on).
7. Remove components from detector electronic racks on experimental floor.
8. Remove cable trays around storage ring (not allowed).

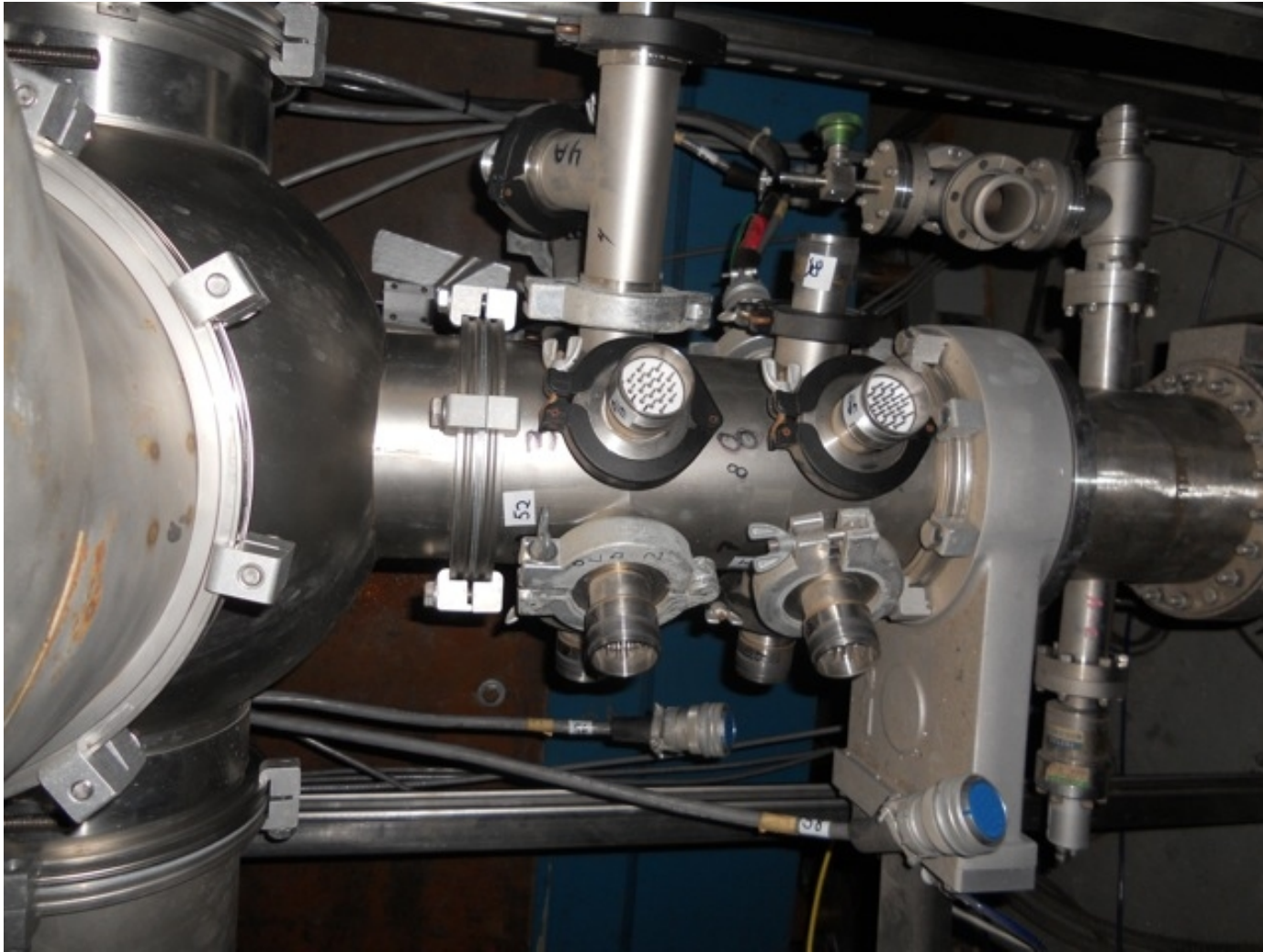
Key ingredient for reassembly...good documentation



Key ingredient for reassembly...good documentation

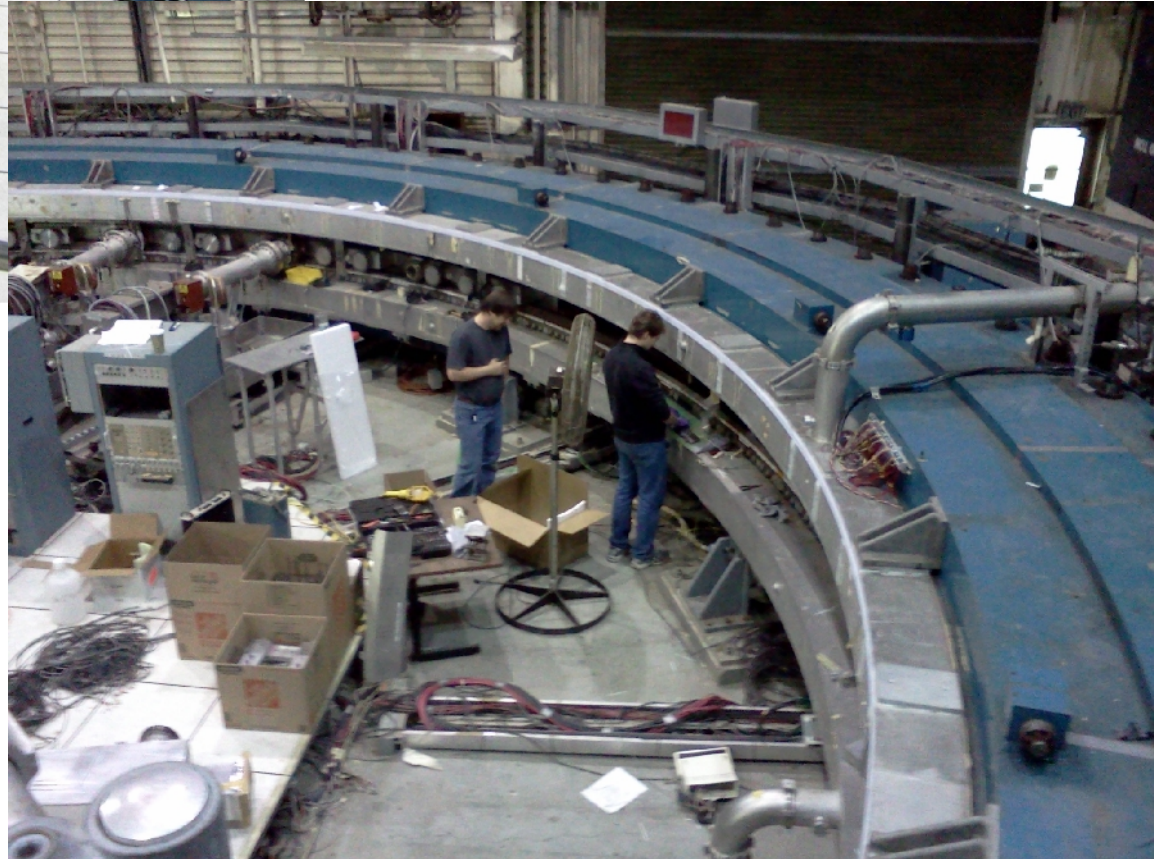
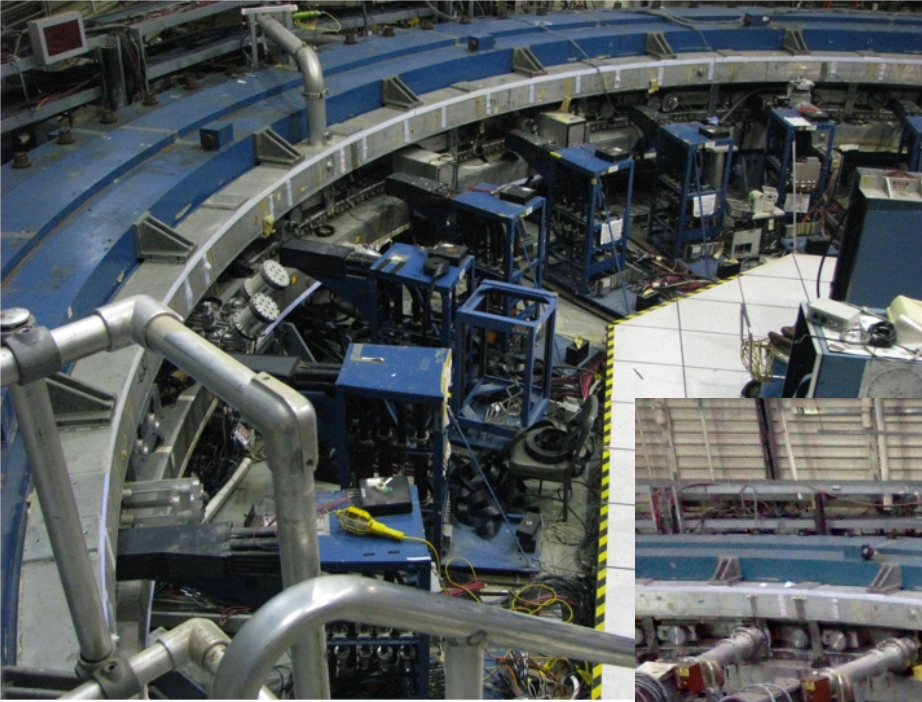


Disconnect, check, and label instrumentation cables



Instrumentation within cryostat tested for proper resistance and for shorts to ground or the superconducting coils...all checked out.

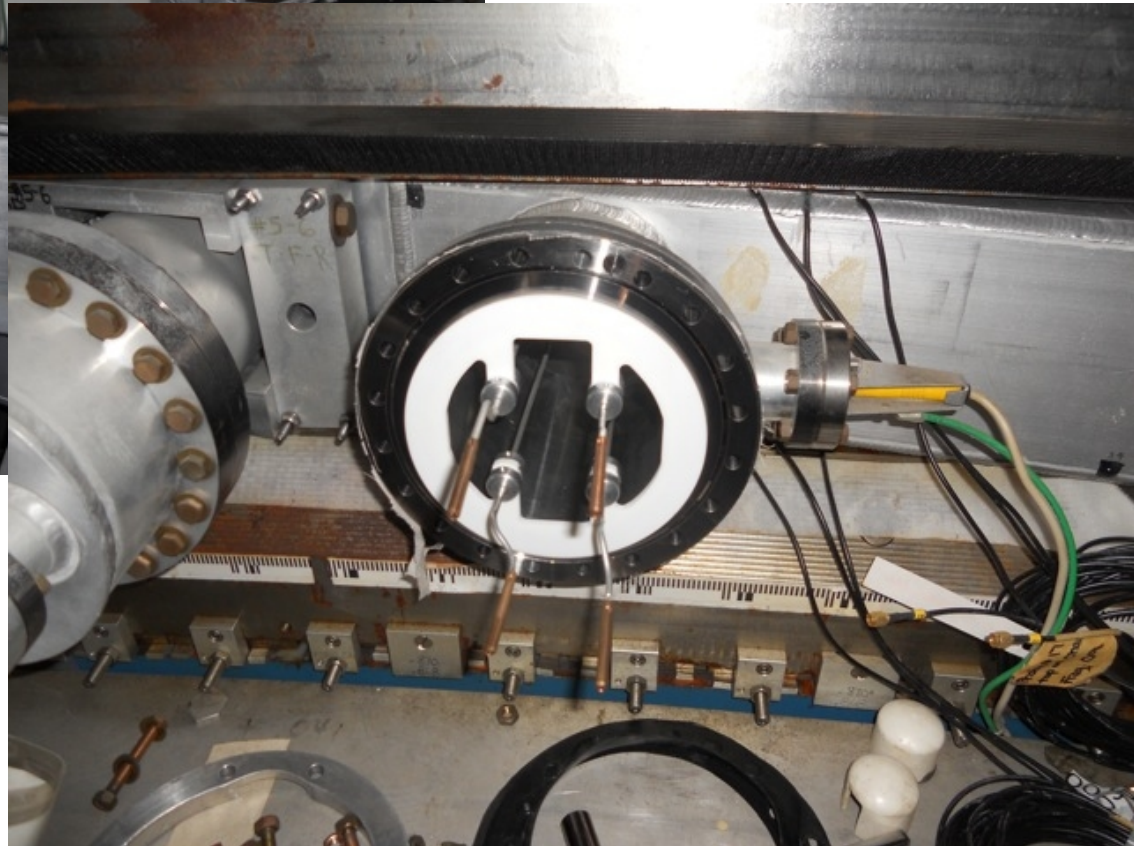
Remove detectors, PMTs removed and packaged for shipping



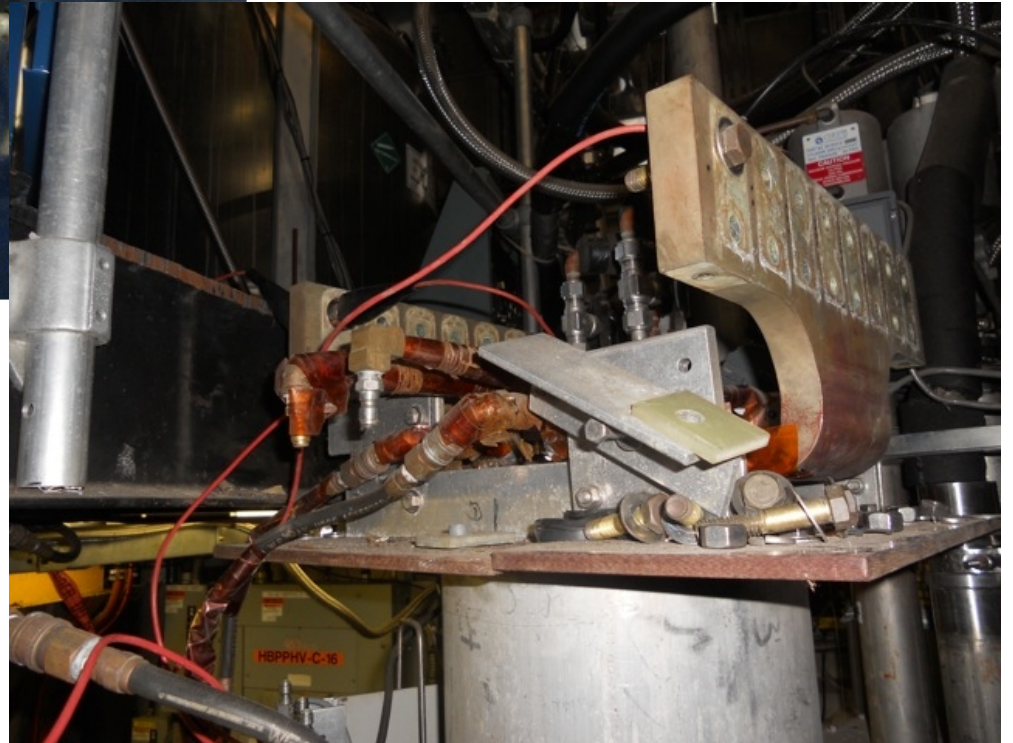
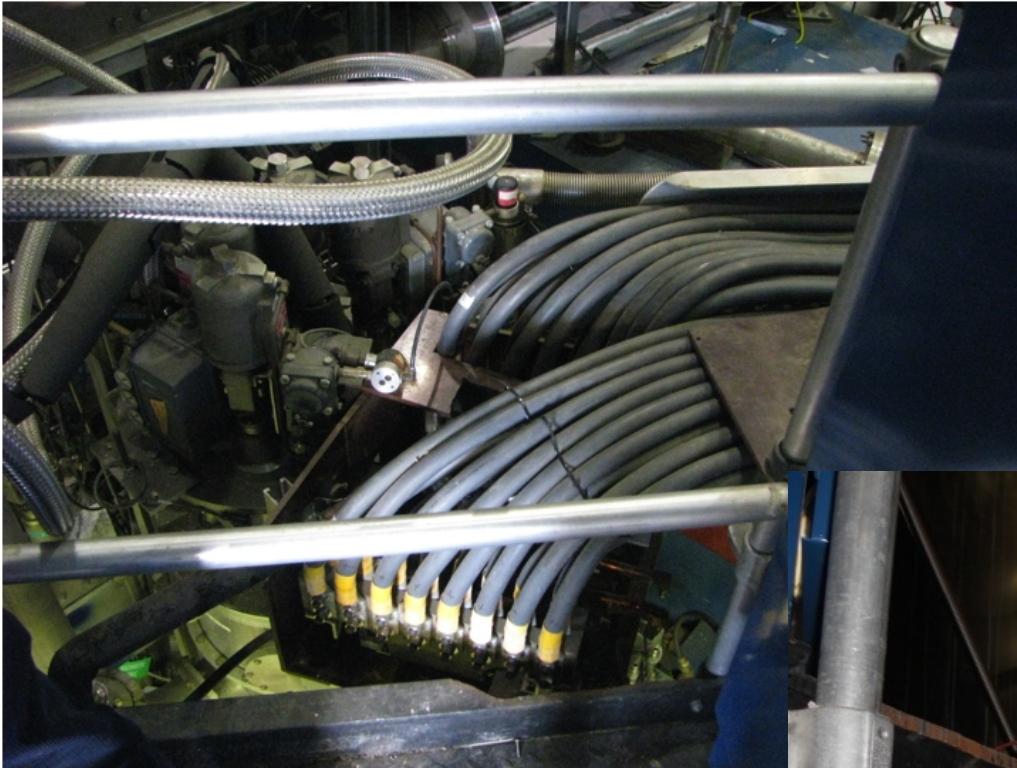
Remove detector floor plates



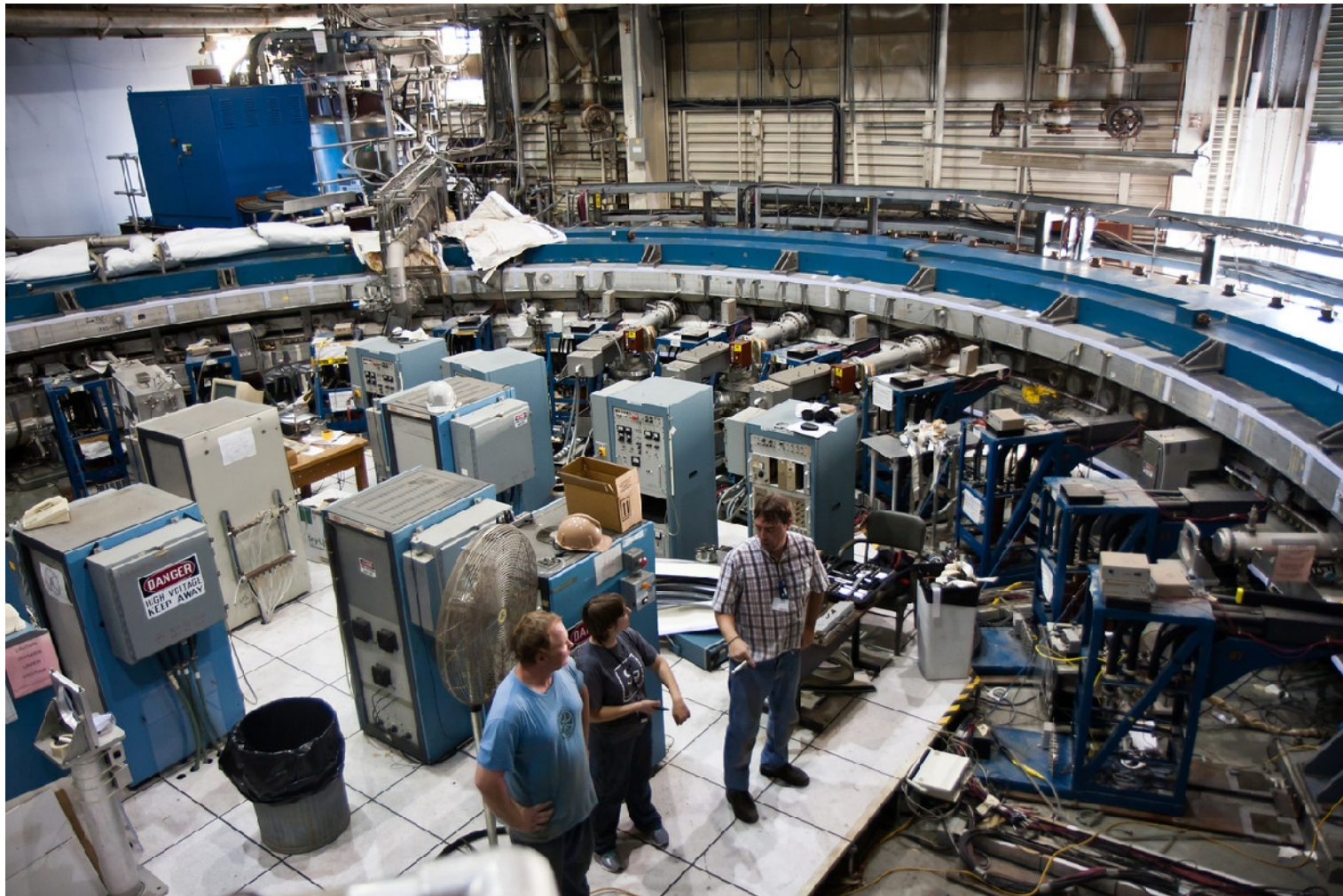
Remove special devices, quad boxes, etc.



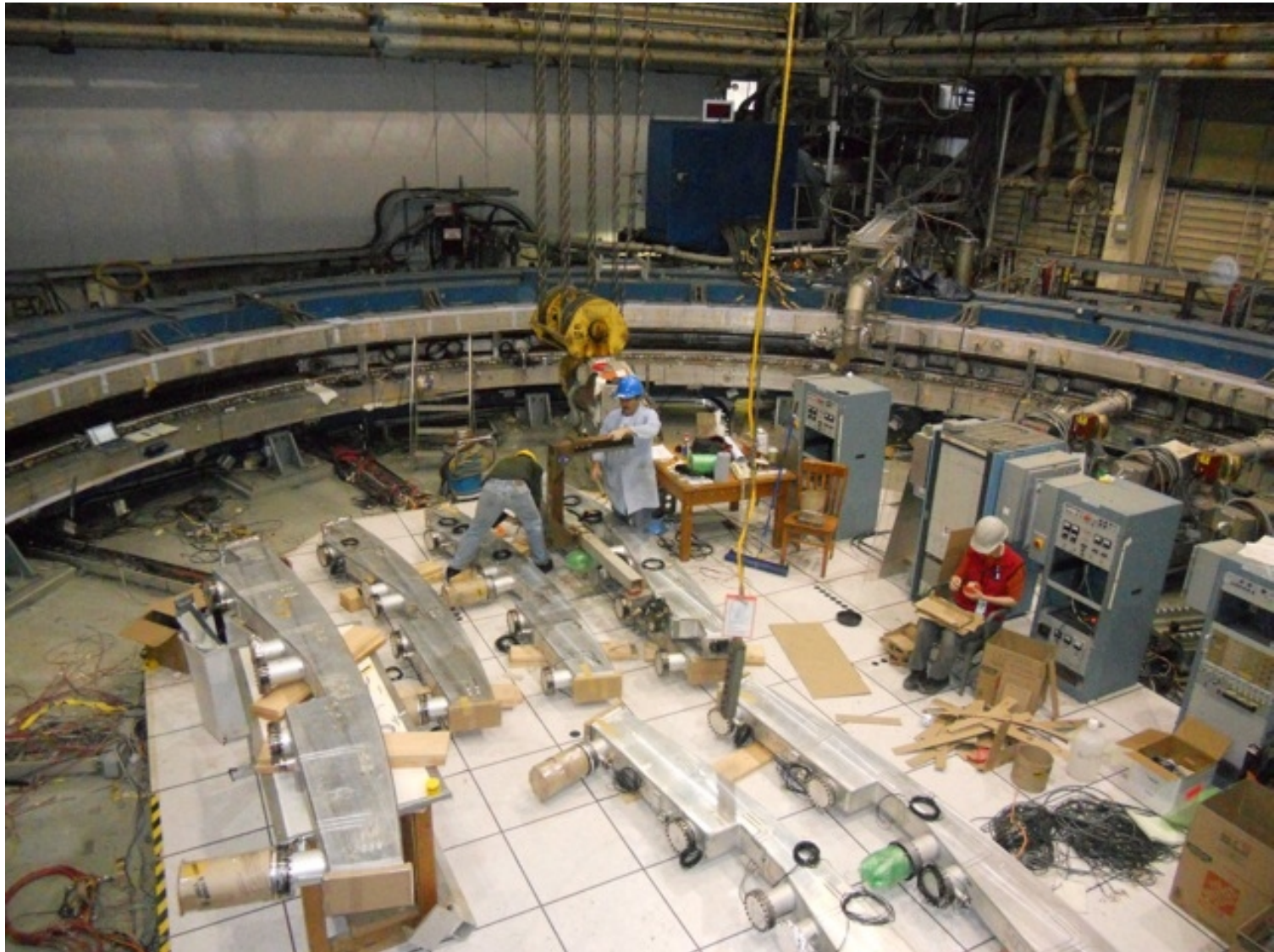
Disconnect magnet power supply



Clear racks, disconnect power supplies, and equipment on floor



Clear racks, disconnect power supplies, and equipment on floor



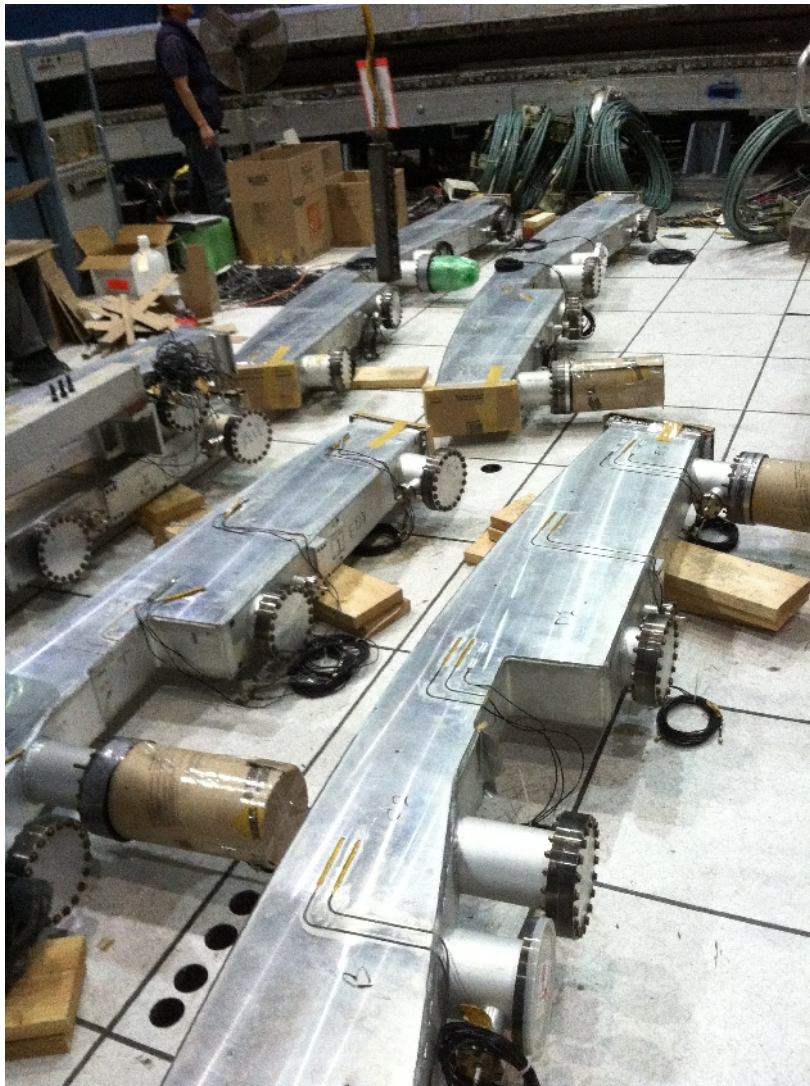
Remove vacuum chambers



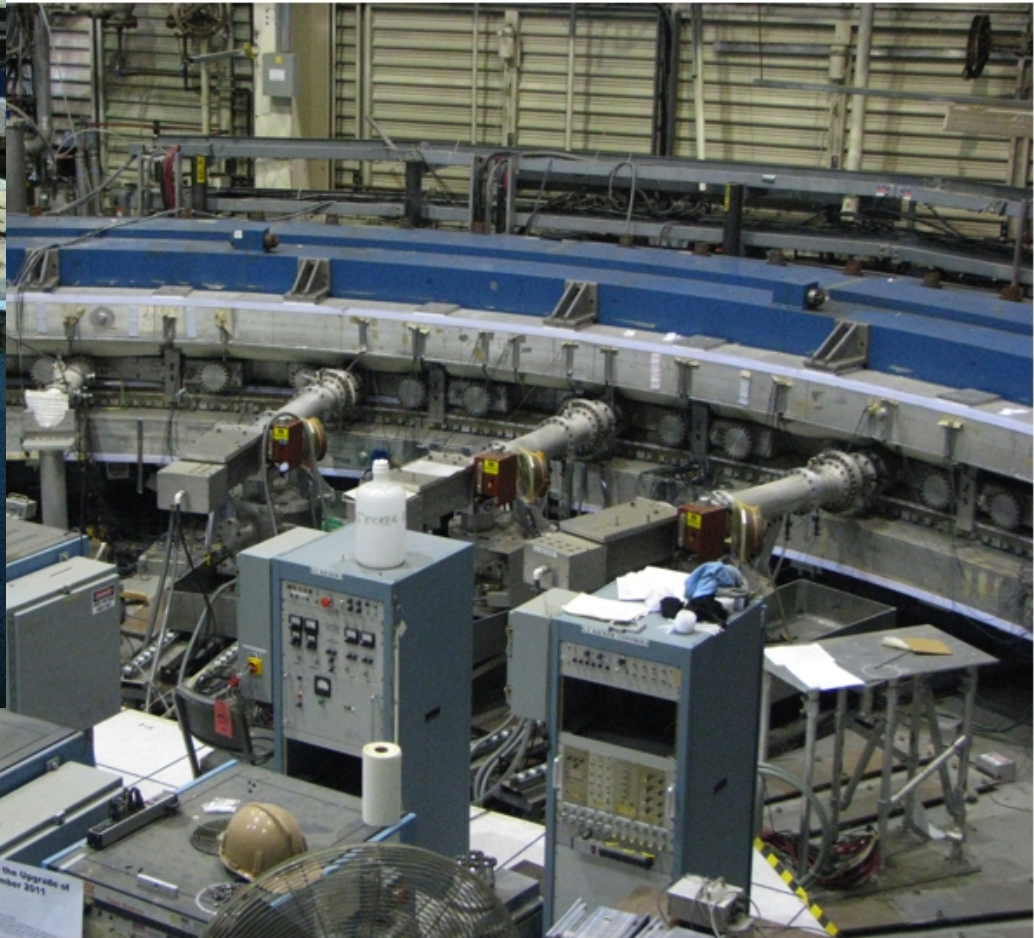
Process chambers for shipping, extract NMR probes



Process chambers for shipping, extract NMR probes



Extract kickers



Extract kickers



All equipment being staged for shipping in nearby compressor room



Work done in April trip

Description	Materials (Direct)		Total Mat'ls w/Indirects	Eng'r	Physicist	Labor Hours				DTS	Shops	Total Labor Cost	
	<\$25000	>\$25000				Design	Tech	Assigned				w/Indirects	Total
Experimental equipment removal													
remove detectors/plates	\$500		\$746				200	80				\$44,800	\$45,546
remove rack equipment			\$0		40		150					\$32,000	\$32,000
remove racks, etc			\$0				100					\$16,000	\$16,000
remove tray/poles							160					\$25,600	\$25,600
Ring removal													
Disconnect vacuum				20			160					\$29,200	\$29,200
Disconnect power supplies				20			160					\$29,200	\$29,200
Cryo disconnect / removals				40			320	160				\$84,000	\$84,000
Remove cables	500		\$746	20			320					\$54,800	\$55,546
Remove power, tray								160				\$25,600	\$25,600
Remove ring top half and prep				20			320	320				\$106,000	\$106,000
Remove coils				20			80	240				\$54,800	\$54,800
Remove vac chambers/store			\$0	20			160					\$29,200	\$29,200
Remove ring lower half & prep				20			320					\$54,800	\$54,800
Remove back and prep				20			60					\$13,200	\$13,200
Remove stands and plates							240					\$38,400	
Remove computer floor								80				\$12,800	\$12,800
Trolley box/trolley							40					\$6,400	\$6,400
remove inflector/chamber				20	10		400					\$69,600	\$69,600
pole tips and prep				20			720					\$118,800	\$118,800
survey poles							160					\$25,600	\$25,600
discon cryo piping				40			320					\$58,400	\$58,400
discon / remove cryo cables							160					\$25,600	\$25,600
prepare coil leads for shipp	\$5,000		\$7,461	120			1500					\$261,600	\$269,061
Quad Boxes and leads/store			\$0	20	20		240					\$46,000	\$46,000
Special devices			\$0	60	20		240					\$53,200	\$53,200
Kicker removal/store				20	20		160					\$33,200	\$33,200
clean up	\$5,000		\$7,461				120	120	100			\$50,070	\$57,531
crates	\$10,000		\$14,921										\$14,921
Modifications for ship							120	40				\$25,600	\$25,600
New lifting rig							?						
TOTALS	\$21,000	\$0	\$31,334	500	110		6930	1200	100	0		\$1,424,470	\$1,455,804

Completed \$294k of line items in April! Leaves \$1162k left in estimate (excluding lifting fixture)...probably spent \$80-100k

How did we do it?

- 1) Hard work...
- 2) BNL supervisor John Benante kept special crews coming as needed
- 3) FNAL tech Kelly Hardin accomplished an incredible amount
- 4) We kept general crew busy (myself, Aria, Hogan, Abid, Carsten, Robin)
- 5) Two week special trip environment fosters a good sense of team...people work hard 12 hour days and really enjoyed the feeling of accomplishment

Planning second trip May 15-29

Description	Materials (Direct)		Total	Eng'r	Physicist	Labor Hours				DTS	Shops	Total	Total
	<\$25000	>\$25000	Mat'ls w/Indirects			Design	Tech	Assigned	Labor Cost w/Indirects				
Experimental equipment removal													
remove detectors/plates	\$500		\$746				200	80				\$44,800	\$45,546
remove rack equipment			\$0		40		150					\$32,000	\$32,000
remove racks, etc			\$0				100					\$16,000	\$16,000
remove tray/poles							160					\$25,600	\$25,600
Ring removal													
Disconnect vacuum			\$0	20			160					\$29,200	\$29,200
Disconnect power supplies				20			160					\$29,200	\$29,200
Cryo disconnect / removals				40			320	160				\$84,000	\$84,000
Remove cables	500		\$746	20			320					\$54,800	\$55,546
Remove power, tray								160				\$25,600	\$25,600
Remove ring top half and prep				20			320	320				\$106,000	\$106,000
Remove coils				20			80	240				\$54,800	\$54,800
Remove vac chambers/store			\$0	20			160					\$29,200	\$29,200
Remove ring lower half & prep				20			320					\$54,800	\$54,800
Remove back and prep				20			60					\$13,200	\$13,200
Remove stands and plates							240					\$38,400	
Remove computer floor			\$0					80				\$12,800	\$12,800
Trolley box/trolley			\$0				40					\$6,400	\$6,400
remove inflector/chamber			\$0	20	10		400					\$69,600	\$69,600
pole tips and prep			\$0	20			720					\$118,800	\$118,800
survey poles			\$0				160					\$25,600	\$25,600
discon cryo piping				40			320					\$58,400	\$58,400
discon / remove cryo cables							160					\$25,600	\$25,600
prepare coil leads for shipp	\$5,000		\$7,461	120			1500					\$261,600	\$269,061
Quad Boxes and leads/store			\$0	20	20		240					\$46,000	\$46,000
Special devices			\$0	60	20		240					\$53,200	\$53,200
Kicker removal/store				20	20		160					\$33,200	\$33,200
clean up	\$5,000		\$7,461				120	120	100			\$50,070	\$57,531
crates	\$10,000		\$14,921										\$14,921
Modifications for ship							120	40				\$25,600	\$25,600
New lifting rig							?						
TOTALS	\$21,000	\$0	\$31,334	500	110		6930	1200	100	0		\$1,424,470	\$1,455,804

Potentially another \$260k of line items in May leaving \$900k...BNL ready to commit \$285k...means FNAL potentially only needs to find \$600k to finish